ONE SIZE DOES NOT FIT ALL: REMOVING UNNECESSARY BARRIERS TO ENTRY IN THE PILOT COMMUNITY

Graduate Research Paper

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Abstract

One of the challenges the United States Air Force (USAF) faces in the pilot career field is a lack of female representation. The current USAF pilot height requirements eliminate approximately 55% of the female population from pilot qualification. Individuals who do not meet the generalized height requirements must apply for a waiver, which would qualify them to pilot a specific set of aircraft based on anthropometric compatibility standards. If the USAF implemented tailored standards as policy instead of the exception, it could eliminate the need for anthropometric waivers and increase the qualified female pilot candidate pool.

This research examines the effects of implementing anthropometric tailored standards on cadet motivation to pursue careers as USAF pilots. The purpose of this research is to determine how gender and height affect motivation to pursue a pilot career. A survey method was employed to answer the research question: “How do the current Flying Class I height requirements affect motivation of USAF cadets to pursue careers as USAF pilots?”

The responses of 398 cadet participants showed that both gender and height help predict motivation to pursue a career as a pilot. These results support the claim that changing the USAF height requirements policy could increase the motivation of women to become pilots.

For all those little girls with big dreams.

Acknowledgments

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Taylor S. Rigollet

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I. Introduction

General Issue

United States Air Force (USAF) recruiting posters, videos, and advertisements rely upon images of USAF jets soaring through the air, protecting Americans and their families. These thrilling images may be successful attracting young Americans deciding what to do with their future. However, once these potential USAF recruits begin to investigate the requirements to become a USAF pilot, approximately 55 percent of females and 6 percent of males will find that they do not meet the height qualification standards (Hudson, Zehner, & Roinette, 2003). This immediate elimination may be enough to dissuade them from further pursuit of a career serving in the USAF.

The USAF is an all-volunteer force, and, ideally, the service volunteers represent the diversity of the American population they are charged with protecting. Women comprise 51 percent of the national population (Cleaves, 2016); however, women account for only 20 percent of the USAF officer corps, and only 6.7 percent of the USAF pilot career field (Losey, 2015). In 2015, the Secretary of the Air Force (SecAF) and the Chief of Staff of the Air Force (CSAF) established a goal to increase the USAF female officer applicant pool to 30 percent (Cleaves, 2016; Losey, 2015).

One USAF policy that affects the female applicant pool is the current anthropometric requirements to be a USAF pilot. To be considered for a pilot slot, individuals must pass a Flying Class I (FCI) physical. The FCI physical standing height requirement is 64 to 77 inches, and the sitting height requirement is 34 to 40 inches (Air

Force Instruction 48-123, 2011). The current FCI height standards are legacy criteria that accommodate the physical requirements for the most restrictive cockpits in the USAF aircraft inventory. Research conducted by the Air Force Research Laboratory (AFRL) from 1997 through 2000 determined the smallest and largest people that can safely operate each USAF aircraft (Zehner & Hudson, 2002). This research established functional anthropometric accommodation envelopes for each aircraft in the USAF inventory (Zehner & Hudson, 2002). Using data from this study, researchers developed software that can accept inputs of specific anthropometric dimensions and generate an output of all the aircraft in which that individual is safe to operate (Zehner & Hudson, 2002). This software program is called web Pilot Accommodation Study (webPASS) and is kept updated with the appropriate functional dimensions required for new aircraft added to the USAF inventory (J. Hudson, personal communication, December 30, 2016).

Though the USAF funded the research to determine anthropometric accommodation envelopes, the USAF fails to recognize these different functional requirements for individual aircraft as FCI requirements. Instead, the FCI anthropometric requirements are generalized into one conservative standard (i.e. standing height of 64 to 77 inches, and a sitting height of 34 to 40 inches), thereby eliminating approximately 55 percent of the female population and 6 percent of the male population from pilot qualification based on height (Air Force Instruction 48-123, 2011; Hudson, Zehner, & Roinette, 2003). Individuals who do not meet the generalized standing or sitting height requirements must apply for a waiver, which would qualify them to pilot a specified set of aircraft, or a tailored pipeline, based on the functional anthropometric accommodation envelopes accounted for in webPASS. An example of a waiver candidate's possible approved tailored pipeline based on webPASS outputs might be, primary phase: T-6, advanced phase: T-1, and formal training unit major weapons system (MWS): C-5, KC-135, C-17, and KC-10. The example tailored pipeline would approve the candidate to fly only the listed aircraft. These aircraft allow the candidate to complete all required phases of Undergraduate Pilot Training and continue on to a career in the USAF flying any of the four MWSs listed. Approval of a waiver is not guaranteed, and the USAF does not codify what criteria are utilized to determine approval or disapproval. Instead, lack of transparency in the waiver process creates a potential barrier for those working to pursue a career as a USAF pilot.

If the USAF implemented the criterion based tiered height standards as policy for FCI height qualification, it could lower the overall standing and sitting height requirements, thus, expanding the qualified pilot applicant pool and eliminating the need for height waivers. Removing the waiver requirement as a barrier to entry could increase the motivation of the expanded pool of individuals to pursue careers as USAF pilots. Motivation as related to this research addresses the relation between values and action (Feather, 1988). Expectancy-Value theory of motivation (EToM) is the framework used in this research to discuss motivation related to pursuit of a pilot career and the associated influential constructs.

EToM highlights expectancy of success and value of a task as the two second order constructs of motivation (Eccles & Wigfield, 2002). The research efforts of Eccles (1983) demonstrate the influence of these two second order constructs on overall motivation regarding future achievement behavior. Expectancy of success is centered on an individual's perceived probability that their effort will lead to success in a particular task (Rodgers, 2008). If an individual's expectancy of success increases, it is likely that their overall motivation to accomplish the task will also increase. The perceived value of a task is associated with the level of importance and usefulness an individual assigns to that task (Eccles, 1983). The perceived effort or cost associated with a task has a negative impact on assigned task value (Eccles, 1983). As perceived effort increases, task value generally decreases, thus, likely causing overall motivation for task accomplishment to decrease.

Changing the USAF policy for FCI height requirements has the potential to influence the second order constructs of motivation as they pertain to EToM, (e.g., increasing candidates' expectancy of successfully obtaining a pilot slot or decreasing the perceived work required to get a pilot slot, thus increasing task value). The relationship between expectancy of success, task value, and overall motivation make EToM an ideal theory to use in this research. This research examines the validity of height and gender influences on motivation through the lens of EToM and recommends a FCI height policy change.

Problem Statement

USAF policy eliminates approximately 55 percent of the female population and approximately 6 percent of the male population from initial pilot qualification based on height restrictions. Additionally, there is a lack of female representation in the USAF pilot career field when compared to the national population.

Research Objectives and Focus

This research focuses on cadet motivation to pursue careers as USAF pilots. The purpose of this research is to determine how gender and height affect motivation to pursue a pilot career.

Research Question:

How do the current Flying Class I height requirements affect motivation of USAF cadets to pursue careers as USAF pilots?

Investigative Questions:

Does gender affect cadet motivation to pursue careers as USAF pilots?

Does standing height affect cadet motivation to pursue careers as USAF pilots?

Methodology

This research used a survey methodology (Weisberg, Krosnick, & Bowen, 1996). Based on the previously validated Motivations for Reading Questionnaire (MRQ) (Wigfield, Guthrie, & McGough, 1996), the Air Force Pilot Motivation Questionnaire (AFPMQ) (Appendix B) was augmented and offered to 1996 ROTC cadets with a response rate of 19.9 percent. Section III and Section IV contain details about the questionnaire and an analysis of the results.

Assumptions/Limitations

EToM provides the ideal framework to examine this research question. However, it was a challenge to find a validated EToM measurement tool. The lack of EToM measures available was one of the initial limitations. The AFPMQ questionnaire utilized in the data collection was adapted from the MRQ, a previously validated EToM questionnaire. Due to the exploratory nature of some of the military-specific adaptations, some construct scales demonstrated lower than ideal reliability scores. Future uses of these constructs should focus on refining these scales and a more robust statistical validation process. For example, while ROTC cadets served as the ideal sample group to measure pre-career motivation, future research should sample a wider population swath (e.g., pilot applicants who have submitted height waivers).

Remotely piloted aircraft (RPA) pilots must medically qualify under initial flying class two (IFC IIU) requirements (Air Force Instruction 48-123, 2011). IFC IIU height requirements are not the same as FCI requirements (USAF MSD, 2016). Due to the differences between IFC IIU and FCI height requirements it was important that the research specified the focus on pilots of traditional aircraft. Questionnaire participants were notified that when they saw the word “pilot”, they should assume that referred to a pilot of a traditional aircraft and not a RPA. Throughout this research, it is assumed that any discussion of pilots does not include RPA pilots as a consideration.

Implications

In February of 2016, the USAF was 1412 pilots short of the required 20,307 needed in the force (Cooper, 2016). This shortage is projected to increase over the next decade (Cooper, 2016). The USAF set a goal to increase the female officer applicant pool to 30 percent (Cleaves, 2016). Implementing a tailored pipeline protocol for pilot qualification based on anthropometric compatibility could increase the number of qualified pilot candidates and be a part of the solution to the pilot shortage. If a large number of these newly qualified candidates are female; this could help the USAF meet the 30 percent female applicant pool goal and tangentially change a policy that perpetuates unintended discrimination.

II. Literature Review

Chapter Overview

Caucasian male pilots dominate aviation history, specifically in the military. Therefore, the average Caucasian male was the model for many of the first aircraft and clothing designs, as well as the associated aviation regulations. Unfortunately, these same designs and regulations, such as the restrictive height minimums, do not match today's diverse USAF population and unintentionally create an unnecessary barrier to entry into the USAF pilot career field.

The USAF established safe anthropometric accommodation envelopes that are used to approve height waivers. Implementing the anthropometric accommodation envelopes as FCI policy would remove the unnecessary legacy height barriers to entry for the pilot career field. Eliminating a barrier may raise cadets' perceived expectancy for successfully obtaining a pilot slot or decrease their perceived effort required for the process, thus, increasing their motivation to seek a career as a pilot. The Expectancy-Value theory of motivation (EToM) explains the process cadets may use to make a decision on various career alternatives (Chiang, Jang, Canter, & Prince, 2008). EToM's focus on the decision-making process provides valuable insights to potential influences on cadet motivation to pursue careers as pilots in the USAF.

Historical Perspective

Often, the accounts and achievements of men define aviation and military history (Lomax, 1986). It is rare that the historic journeys of early women and minority pioneers in these fields are well documented or preserved. Often when women tried to integrate into aviation or military service, they were met with opposition. In the 1930's Amelia Earhart and Eleanor Roosevelt proposed that the United States military incorporate female pilots into their pool. However, military aviation pioneer, General Henry "Hap" Arnold, responded by saying, "The use of women pilots serves no military purpose" (Lomax, 1986). Senior leader attitudes such as this slowed women's progress in the military as well as in aviation and led to a long history of fighting for changes to policy shaped around male servicemen.

The history of successful USAF policy changes began when the USAF became a separate military service in 1947:

- In 1948 the Women's Air Force (WAF) accepted 4,300 women to serve in clerical and medical roles, but specifically not to be trained as pilots (Lockwood, 2014).
- In 1967 the two percent cap on the number of women serving in the WAF was lifted, along with the restriction on the highest grade women could achieve (Lockwood, 2014).
- In 1973 it was ruled that women's dependents were eligible for the same benefits and privileges afforded to the dependents of male military members (Lockwood, 2014).
- In 1975 the Department of Defense reversed the policy that required pregnant women or adoptive mothers to be discharged (Lockwood, 2014).
- In 1976 the USAF selected the first female for undergraduate pilot training and allowed the first females into the Air Force Academy (Lockwood, 2014).
- 1993 was the first time women were permitted to compete for assignments in aircraft that engaged in combat missions (Weber, 1999).

Throughout the short history of the USAF, policies, and regulations discriminating against women have been changed and adapted to meet the needs of the airmen serving as well as the needs of the USAF as a whole. As evident by the historical record of policy changes required in the USAF, women were not considered when many of these policies were created. However, as women have become an integral part of the force, the USAF must update policies that create unintended discrimination. The USAF anthropometric databases demonstrate how accounting for women can sometimes be an afterthought.

The United States Air Force Anthropometrics

The only USAF anthropometric database that exists for aircrew product design is the 1967 USAF Aircrew Anthropometric Survey, representing only the male aircrew population (Choi, et al., 2014). In 2011 the USAF funded an Aircrew Sizing Survey (ACSS) to replace the 1967 Survey (Choi, et al., 2014). However, due to funding limitations and utilizing a “volunteer sample strategy,” too few females and non-Caucasian males were measured to adequately account for those demographics (Choi, et al., 2014). With the data acquired, it was possible to utilize ACSS as the updated anthropometric database for the male USAF Aircrew Population; however, the female USAF Aircrew Population database had to be derived from the 2012 Army Anthropometric Survey (ANSUR II) (Hudson, et al., 2016; United States Army, 2012). The ACSS was implemented to replace an antiquated, all male survey; however, it only resolved a portion of the problem. The use of the ANSUR II data as a “work around” to account for the lack of female representation in the ACSS is a parallel example to the use of a waiver process as a “work around” to account for the lack of female representation in the FCI anthropometric requirements. The necessity for “work arounds” can be eliminated through robust planning and policy design, and would enable the USAF to better account for the needs of all airmen to better serve the force.

Some of the required inclusionary policy design is rooted in research on future workstation and cockpit designs. The USAF utilizes anthropometric databases that encompass populations outside the AFI 48-123 (2011) aircrew requirements to conduct this research (J. Hudson, personal communication, December 30, 2016). The current anthropometric databases the USAF uses for future design purposes are the Matched Military Male database and the Matched Military Female database, both of which were derived from ANSUR II using USAF Fitness data (Hudson, et al., 2016). Figure 1 shows the current AFI 48-123 (2011) standing and sitting height restrictions for FCI physicals overlaid on the Matched Military Male database while Figure 2 shows these same restrictions overlaid on the Matched Military Female database (Hudson, et al., 2016). In both figures, the dots outside the black box represent all the people who would not meet the height requirements to pilot a USAF aircraft.

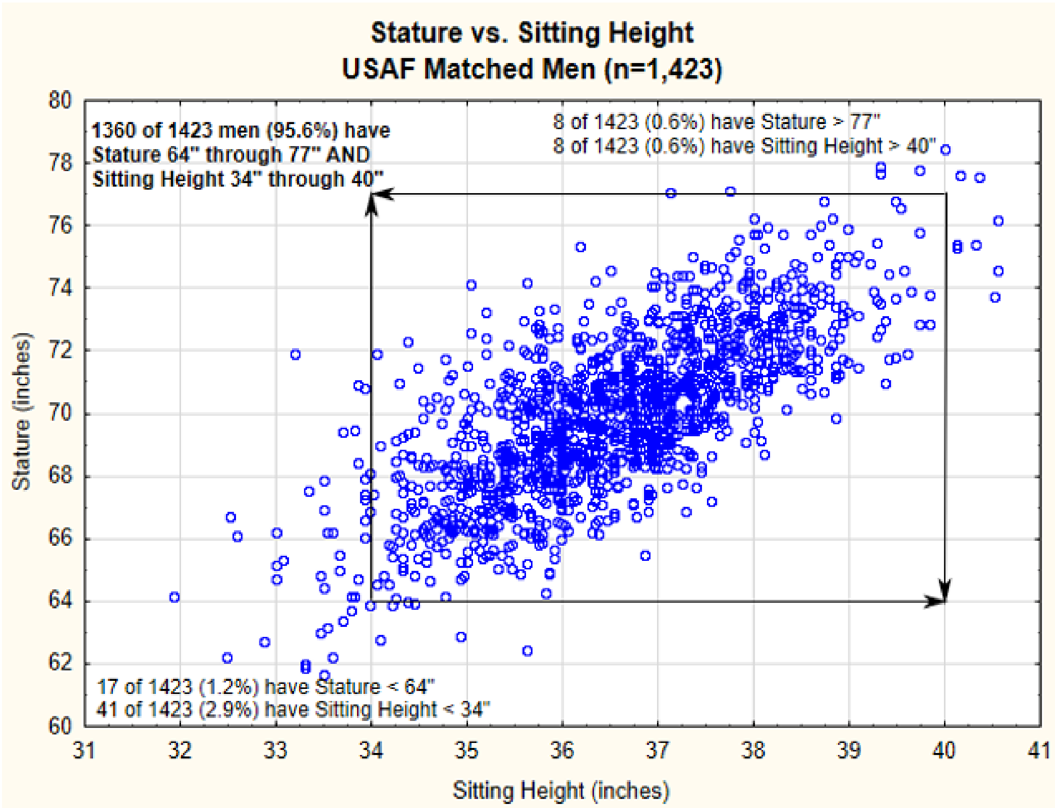


Figure 1 USAF Requirements & Matched Military Male Database

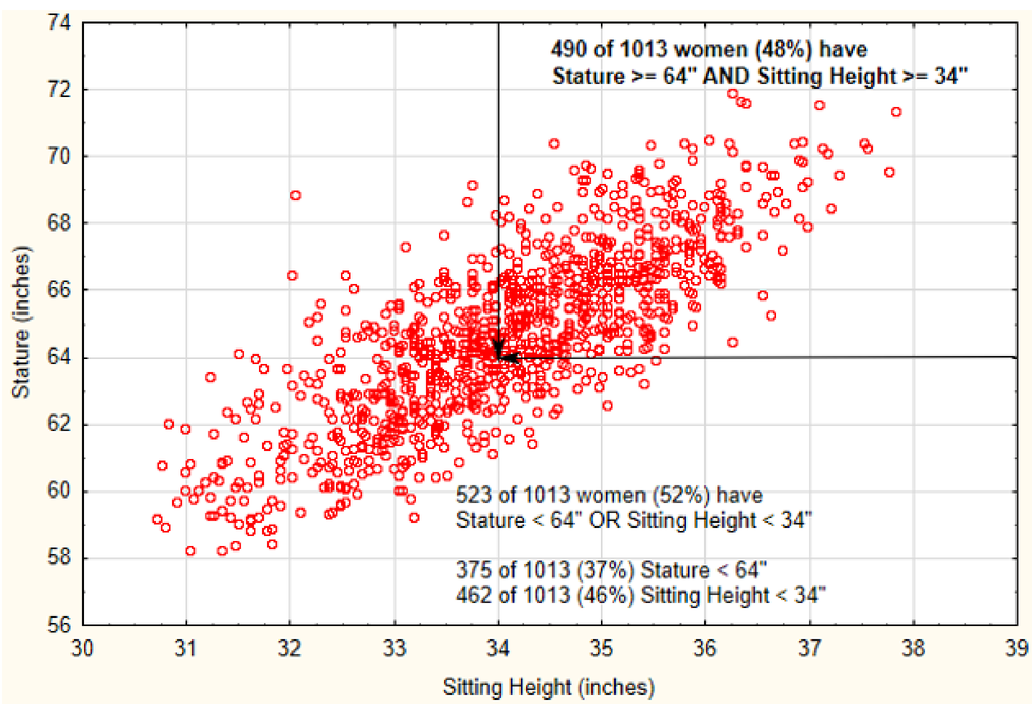


Figure 2 USAF Requirements & Matched Military Female Database

Figure 1 and Figure 2 show that 4.4 percent of men and 52 percent of women do not meet the standing or sitting height requirements for the FCI. If these individuals would still like to pursue a career as a USAF pilot, they must apply for an anthropometric waiver in accordance with Air Force Medical Standards Directory (MSD) and Air Force Waiver Guide (AWG).

The United States Air Force Waiver Process

All pilot candidates for Undergraduate Pilot Training must meet FCI standards (Air Force Instruction 48-123, 2011). If candidates' standing height measures less than 64 inches or more than 77 inches, or their sitting height is less than 34 inches or greater than 40 inches, they do not meet the FCI standards to attend pilot training (USAF MSD, 2016). USAF experts in the field of biological anthropology do not know the origins of these height restrictions or the criteria used to establish the legacy anthropometric requirements. Rather, the use of the inherited legacy restrictions are "the way it has always been" (J. Hudson, personal communication, March 7, 2017).

Candidates who do not meet the FCI anthropometric standards may be considered for a waiver for specific weapon systems and be assigned an anthropometrically compatible tailored pipeline based on the accommodation envelopes established by the AFRL (USAF MSD, 2016). Figure 3 illustrates the three advanced phase USAF pipelines: Airlift/Tanker track, Fighter/Bomber track, and Helicopter track (Hudson, et al., 2016). All USAF pilot students are required to complete training in one of the three advanced phase pipelines to become a USAF pilot.

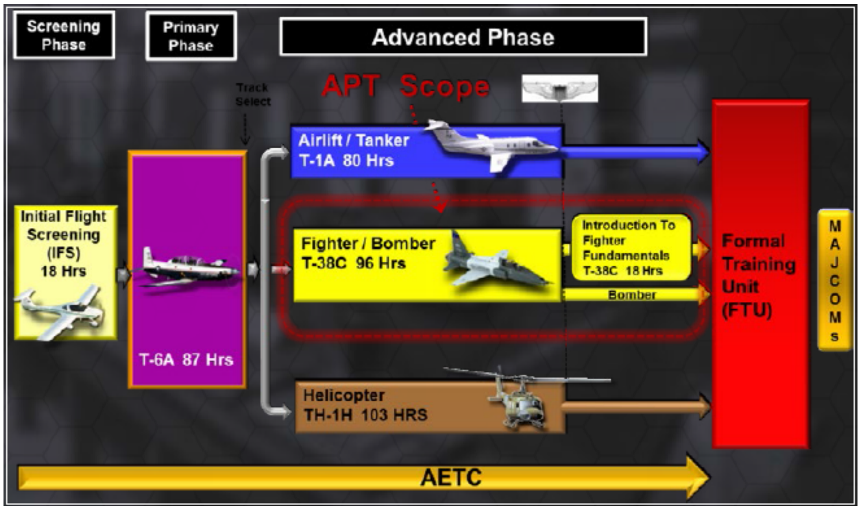


Figure 3 Pilot Training Pipeline

Individuals who decide to apply for an anthropometric waiver must include eight cardinal measurements in their waiver package: standing height, sitting height, buttock-knee-length, sitting knee height, arm span, sitting eye height, acromial height, and functional reach (USAF AWG, 2014). These measurements are taken by an approved Medical Flight Screening clinic and sent to Air Education and Training Command Aerospace Medicine Branch (AETC/SGPA) for data entry into the webPASS computer program developed by the AFRL (USAF AWG, 2014). The webPASS program determines "functional fit" for all USAF aircraft as either "safe," "marginal," or "unsafe" (Figure 4 WebPASS Example). Candidates with "safe" and "marginal" fits are considered adequately able to reach and manipulate the aircraft controls for that particular aircraft (USAF AWG, 2014).

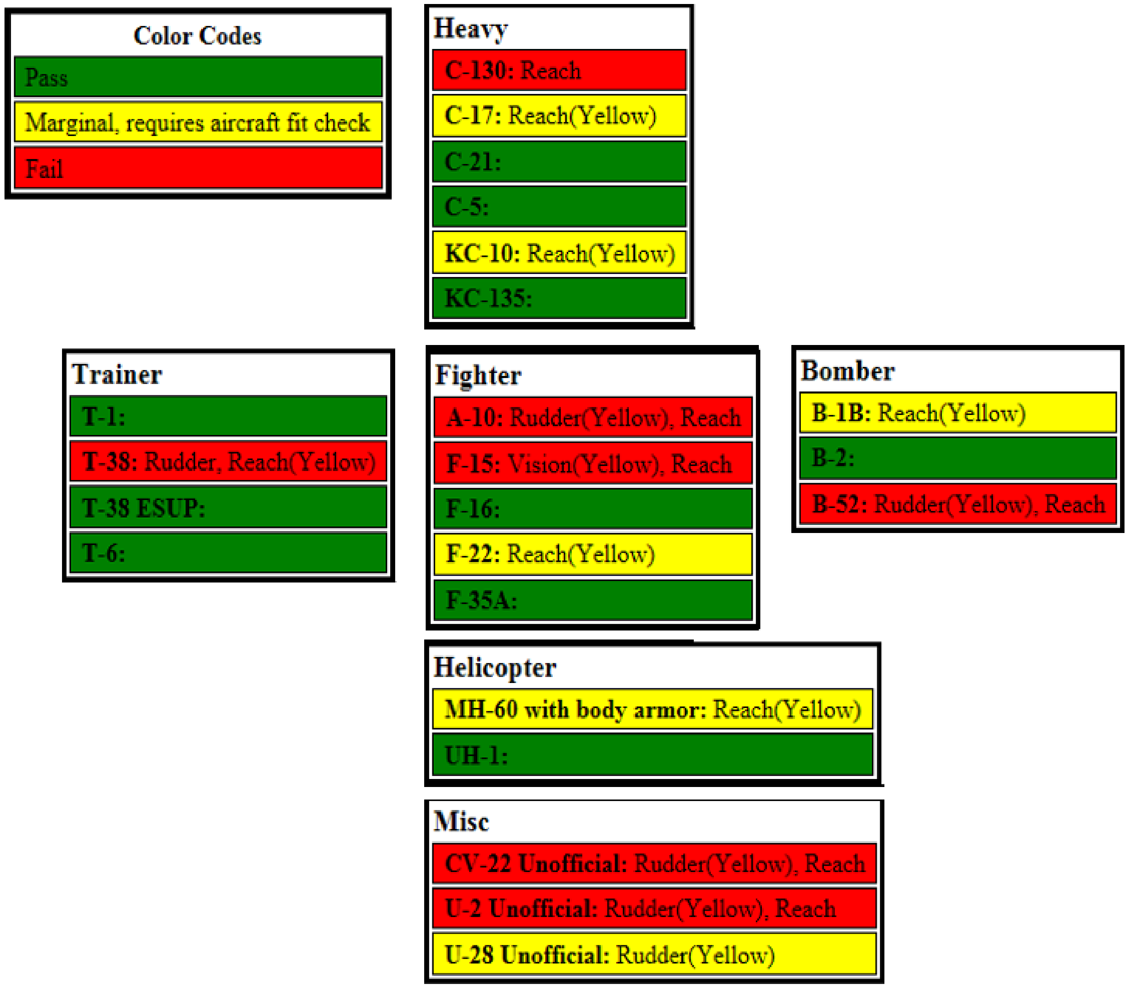


Figure 4 WebPASS Example

Utilizing the webPASS output, the AETC/SGPA makes one of the following waiver recommendations: unconditionally qualified, conditionally qualified for certain aircraft, or disqualified (USAF AWG, 2014). Although the webPASS output is part of the supporting data for the waiver recommendation, the criteria and considerations taken into account for this recommendation are unknown to the candidates and are not codified in any document. The waiver recommendation is coordinated through AETC Directorate of Undergraduate Flying Training (A3F) and forwarded to AETC Directorate of

Intelligence, Operations, and Nuclear Integration (A2/3/10) for final approval (USAF AWG, 2014). Like the AETC/SGPA recommendation criteria, the requirements for waiver approval or disapproval are unknown. Unfortunately, this process has potential to foster uncertainty for pilot candidates applying for an anthropometric waiver. Much of the data entry and decision making for waiver approval is done at a much higher level than the cadet contact level at the Medical Flight Screening clinic, making transparency a challenge. The uncertainty that the process generates could negatively impact cadets' perception of their expectancy for successful waiver approval and increase the perceived effort associated with obtaining a pilot slot.

The United States Navy Pilot Selection Process

In contrast, the medical screening process the United States Navy (USN) utilizes has built-in transparency for pilot candidates. The USN recognizes the different functional requirements for various aircraft in their fleet. They have developed their medical standards around aircraft specific pipelines. All USN aviators undergo full anthropometric measurements and must demonstrate compatibility with a minimum of two fleet and training aircraft pipelines (USN OPNAVINST 3710.37A, 2006).

The USN requires anthropometric measurements for candidates with a standing height greater than 62 inches and less than 77 inches, anyone outside these limits is not eligible to become a naval pilot and waivers are not an option for anthropometric incompatibilities (USN OPNAVINST 3710.37A, 2006). All naval aviator candidates who pass the initial stature height and weight screening must provide the following measurements: sitting height, buttock-knee length, and thumb-tip reach (USN

OPNAVINST 3710.37A, 2006; USN NAVAIRINST 3710.9E, 2017). The USN uses these additional anthropometric measurements to determine qualification for any of their six pipelines: Jets, Multi-Engine, Helicopters, TACAMO, E-2/C-2, or MV-22s (USN OPNAVINST 3710.37A, 2006).

By utilizing a tailored pipeline approach the USN can make their standing height minimum two inches lower than the USAF FCI standards (USN OPNAVINST 3710.37A, 2006), thus including 36.2 percent more women and 2.3 percent more men in their candidate pool (J. Hudson, personal communication, April 13, 2017). Figure 5 and Figure 6 below show the current USN OPNAVINST 3710.37A (2006) standing height requirements for naval pilot physicals overlaid on the Matched Military Male database and the Matched Military Female database respectively. The dots outside the black box represent all the people who would not meet the USN height requirements to pilot a USN aircraft.

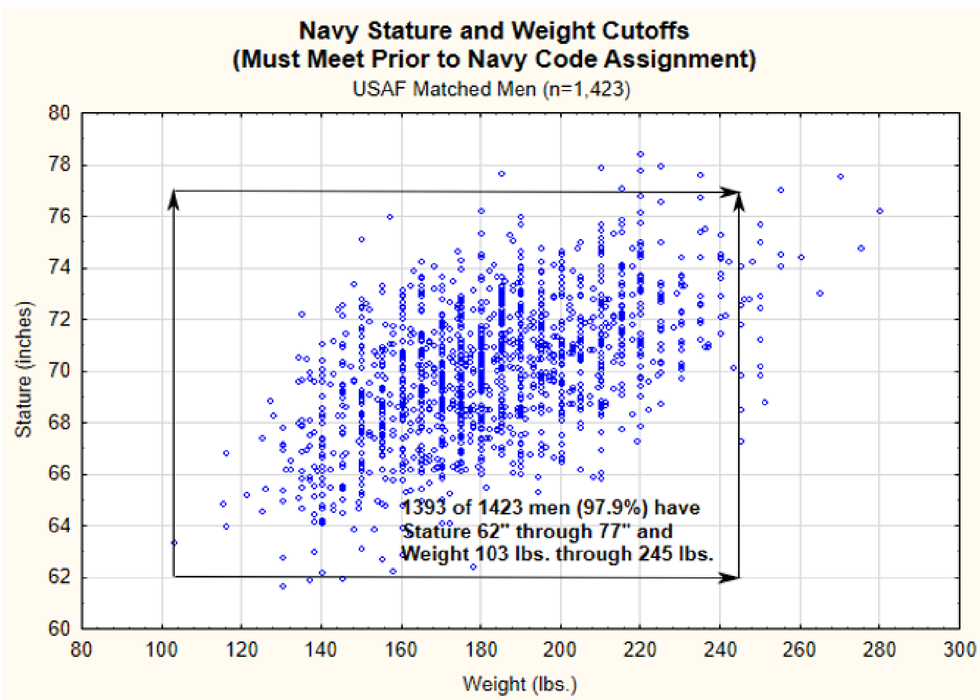


Figure 5 USN Requirements & Matched Military Male Database

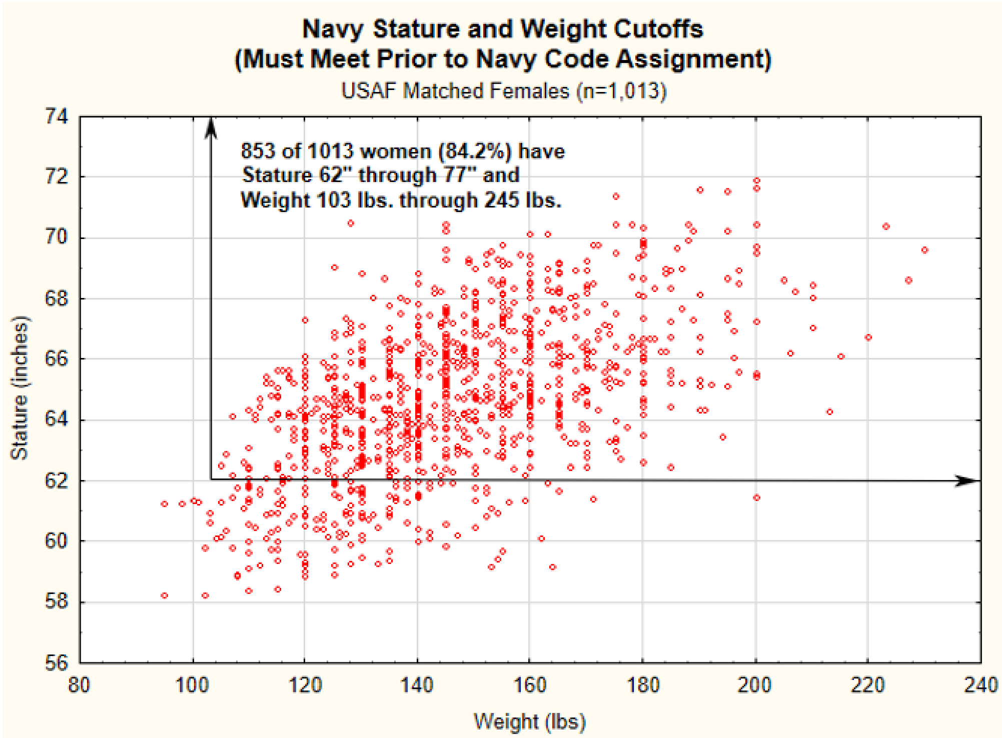


Figure 6 USN Requirements & Matched Military Female Database

Figure 5 and Figure 6 show that 2.1 percent of men and 15.8 percent of women do not meet the naval pilot height and weight qualification requirements for the USN OPNAVINST 3710.37A, 2006.

Another benefit to the USN's approach is that candidates are given clear, realistic expectations on their anthropometric medical qualification for pilot utilizing this process. Candidates are not forced to base expectations on the uncertainty of a waiver approval to choose a career. Expectancy-Value theory of motivation (EToM) provides a framework to explain the impact of individuals' expectations on their motivation to make a task selection.

Expectancy-Value Theory of Motivation

Motivation is a complex human sentiment that has been described by Chen and Zhao (2013) as "…the basic drive for human actions" (p. 315). Motivational scholars utilize various theories about this complex human behavior to frame and guide their research. EToM is an achievement motivation theory that has been cited by many researchers as an appropriate theoretical framework for examining an individual's intention to commit to a particular course of action (DeSanctis, 1983). This paper focuses on cadets' intention to commit to a career as a USAF pilot by examining their levels of achievement motivation as framed by EToM. Achievement motivation describes people's need for success and the desire these individuals have to show competence (Chen & Zhao, 2013). Success and competence are both variables associated with career choice. The focus of this paper is rooted in how gender and height affect the different aspects of achievement motivation integration to motivate an individual to choose to pursue a career as a USAF pilot.

EToM provides an excellent framework for this research because, unlike other motivational theories, EToM does not focus on *what* motivates people, but explains *how* people are motivated to make decisions. "EToM has been widely used to explain how people make decisions in a variety of situations" (Peters & Daly, 2013, p. 248). The USAF is attempting to increase the number of pilots in the force and attract a more diverse population. A critical aspect of accomplishing these two USAF objectives is understanding how individuals are motivated to make the choice to pursue a career as a pilot. The USAF can leverage influential factors uncovered in this process, to execute deliberate policy-making designed to transform the desired decisional outcome.

When individuals are involved in the decision-making process about what career path to choose, they often face a number of options. Again, EToM provides a robust framework for career choice situations because it explains the process individuals use to make decisions between various alternatives (Chiang, Jang, Canter, & Prince, 2008). EToM's focus on the process is critical to this research because the theory provides a structure to explain various influential constructs within the process. Understanding these constructs and the impacts of any manipulation offers a valuable predictive capability.

Other motivational theories such as Maslow's Needs Hierarchy, Alderfer's ERG theory, Herzberg's Two-Factor theory, and McClelland's Learned Needs theory are not as applicable to the foundation of this research. These theories all focus on what motivates people, instead of the process by which individuals choose their behaviors (Gibson, Ivancevich, Donnelly, & Konopaske, 2012).

The central premise of EToM is that people make choices about their behavior based on the perception that it will allow them to achieve the desired outcome (Chiang, Jang, Canter, & Prince, 2008). The majority of decision and achievement theorists have recognized the concept of expectancy or probability of success as a significant variable in determining behavioral choices (Eccles, 1983). People's perceived expectation for success on a particular task is an essential component for predicting the choice they will make on whether or not to participate in that task (Gonzalez-Moreno, 2012). The USN's pilot qualification process provides candidates with reliable anthropometric information upfront, enabling candidates to more confidently assess their expectations for successful pilot qualification.

Although expectancy of success plays a significant role in explaining individuals' choices, it is not the only factor to consider. EToM theorizes that in addition to people's beliefs about how well they will do a particular activity, the extent to which they value the activity will also help predict their choices (Wigfield & Eccles, 2000). Thus, EToM identifies two second order constructs of motivation: expectancies and values (Figure 7) (Eccles & Wigfield, 2002).

Motivation = Expectancy x Task Value

Figure 7 EToM Second Order Constructs

(Chen & Zhao, 2013)

Albeit conceptually straightforward, the influential aspects of both expectancy and task value are complex, and a wide range of variability exists among different theorists concerning particular instrumental aspects. The components of expectancy and task value utilized as the framework for this research are depicted in Figure 8 and explained below as well as in the AFPMQ (Appendix B).

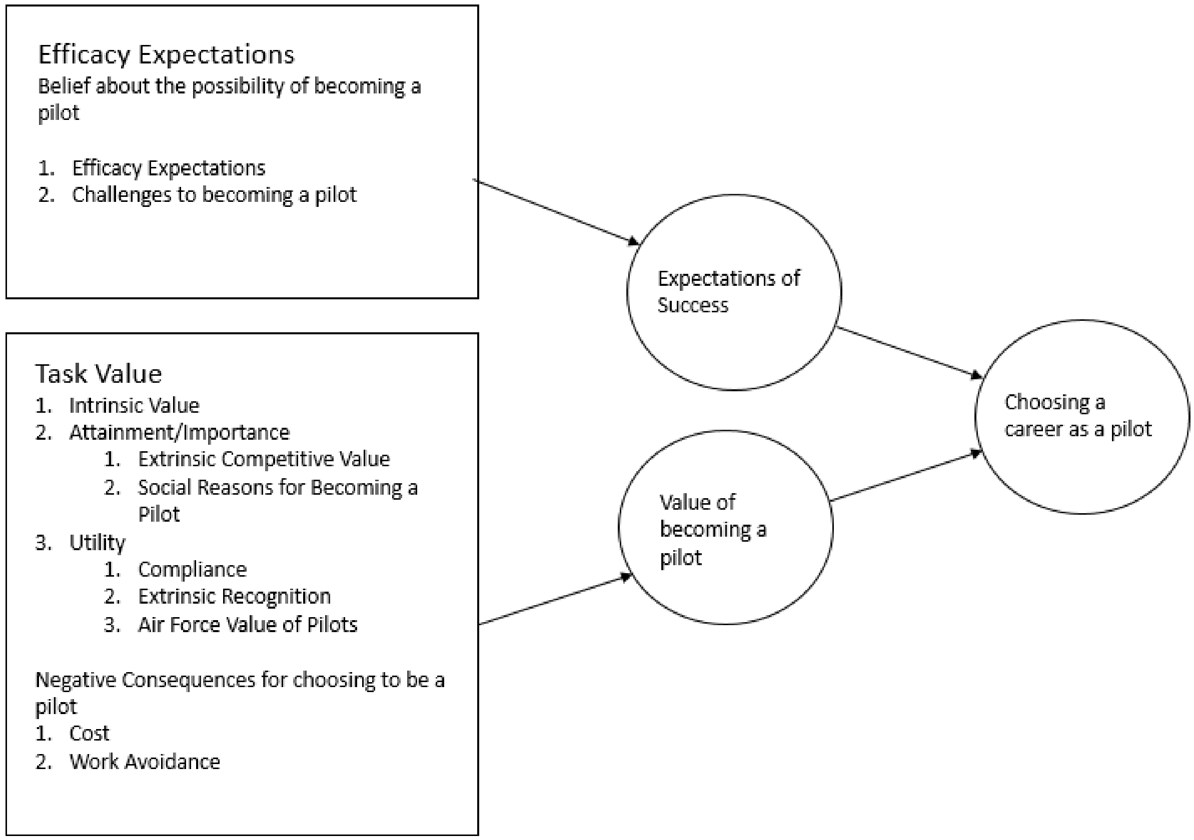


Figure 8 Expectancy-Value Theory of Motivation

There is a deficiency in the EToM literature of available measurement tools. It is important to use a reliable EToM tool for data collection since EToM provides the structure for this research. A previously validated questionnaire assessing children's motivation to read (MRQ), was used as the framework for the AFPMQ. The 11 first order constructs in Figure 8 are represented in the AFPMQ (Appendix B) and have been adapted from the MRQ to ensure accurate EToM measurements.

The expectancy concept of the theory is defined as how well individuals expect to do on a task and their beliefs about their ability to perform the task (Bembenutty, 2012). The AFPMQ utilizes the constructs of efficacy expectations and challenges to becoming a pilot to account for the expectancy concept. An example of an efficacy expectations question is: "I would be a good pilot," and an example of a challenges to becoming a pilot question is: "I think I could realistically be selected for pilot training."

To address the task value construct of the theory, Eccles-Parsons, et al. (1983) outline four motivational components of task value: intrinsic value, attainment value, utility value, and cost. Intrinsic value is a measured construct in the AFPMQ defined as the interest and immediate enjoyment one gets from participating in an activity (Eccles, 1983). One of the questions measuring intrinsic value is: "I like to learn about new things related to flying."

The second component of task value is attainment value. Attainment value, in its most basic form, is the importance of doing well on a task (Eccles, 1983). The importance level of a task includes the task's ability to confirm valued aspects of the self, and fulfill challenges, power, and social needs (Eccles, 1983). Along with an individual construct for attainment, the AFPMQ utilizes the constructs of extrinsic competitive value and social reasons for becoming a pilot to account for attainment value. An attainment value question from the AFPMQ is: "It is important for me to be successful during pilot training." An example of extrinsic competitive value question is: "I would like to be one of the few people selected for pilot training," and a social reasons for becoming a pilot question is: "Many of my friends are planning to be pilots."

Utility value is the third component of task value and assigns importance to a task based on that task's value to help individuals reach a long-term goal (Eccles, 1983). Utility value is related to the concept of extrinsic motivation where the task value increases as the external rewards increase (Wigfield & Eccles, 2000). The AFPMQ utilizes three constructs to measure utility value: compliance, extrinsic recognition, and the USAF value of pilots. An example of a compliance question is: "Getting a pilot slot motivates me to finish my assignments on time." An extrinsic recognition example question is: "I like to get compliments about my pilot abilities or my abilities to earn a pilot slot," and a USAF value of pilots question is: "I want to be a pilot to improve the likelihood that I will reach a high rank in the Air Force."

The final component of cost is the amount of energy will be taken to accomplish a task (Wigfield & Eccles, 2000). Eccles (1983) defines three influential variables on the cost of an activity: perceived effort needed for success, time lost for other valued activities, and psychological cost of failure. The AFPMQ utilizes the constructs of cost and work avoidance to account for the cost of obtaining a pilot slot. An example question from the cost construct is: "The 10-year Air Force commitment following pilot training deters me from wanting to pursue a pilot slot," and an example question from the work avoidance construct is: "I do not like the process for me to get a pilot slot because it is difficult."

The 11 EToM constructs measured in the AFPMQ offer insight into cadets' career decision-making process. EToM describes how beliefs about performance and task value can explain an individual's choice (Wigfield & Eccles, 2000). The AFPMQ utilizes relevant constructs from expectancy and value aspects of EToM to accomplish a comprehensive measure of cadet motivation to pursue a career as a pilot.

Summary

The current USAF FCI height requirements unnecessarily eliminate a large pool of potentially qualified candidates. However, the USN utilizes a pilot qualification process that allows for more inclusive minimum height requirements because they make tailored pipeline delineations based on anthropometric compatibility. The USAF has the data to safely implement a tailored pipeline approach with potentially no additional costs: it would only require a change to policy. Implementing a tailored pipeline policy in the USAF could potentially increase the number of cadets motivated to pursue careers as USAF pilots. EToM provides a valuable framework for examining the impact of a policy change on cadet motivation to pursue careers as pilots. The next chapter of this paper will discuss the methodology and how EToM was employed.

III. Methodology

Chapter Overview

This research employed a survey methodology by implementing a questionnaire as a data collection tool (Weisberg, Krosnick, & Bowen, 1996). Survey research has the capability to capture information about people's attitudes and to understand or predict their behavior (Alreck & Settle, 1995). Questionnaires are adaptable, enabling the research to meet specifically required objectives (Dar Khan, Habibullah, & Ullah, 2013). A previously validated questionnaire measuring motivation, MRQ, utilizing EToM of motivation framework was adapted to assess cadet motivation to become a pilot (Wigfield, Guthrie, & McGough, 1996)

Questionnaire Development

The AFPMQ is adapted from Wigfield, Guthrie, and McGough's (1996) Motivations for Reading Questionnaire (MRQ). The original 54 MRQ items were contextualized for this study and categorized to evaluate 11 constructs of EToM (Appendix B). One of the original constructs from the MRQ is a measure that is unique to the topic of reading (Wigfield, Guthrie, & McGough, 1996). The unique reading construct was replaced with the construct of cost to target and understand the cost-benefits of a USAF pilot career, a construct specific to military populations. All items were assessed on a 4-point Likert scale. Additionally, a 15-item demographic questionnaire was administered before AFPMQ completion and included: gender, age, flying experience, and standing height-(in) (Appendix B). Questions were entered into Survey Monkey, a free web-based platform for survey and questionnaire distribution.

The questionnaire took approximately 15 minutes to complete. To decrease question bias the AFPMQ was approved and revised by subject matter experts with years of experience in the fields of aviation, motivation, questionnaire and survey creation, and anthropometrics.

Prior to the distribution, the Air Force Institution of Technology (AFIT) Institutional Review Board (IRB) approved all protocols associated with this study. Pilot testing was completed to ensure all questionnaire adaptions accurately measured EToM constructs. The pilot testing questionnaire was sent to 10 United States Air Force Academy (USAFA) graduates, 10 Reserve Officers’ Training Corps (ROTC) graduates, and one current USAFA cadet. Seven of these participants are current USAF pilots. None of the individuals who took part in pilot testing were involved in final data collections.

Population

The focus population of this research is any individual affected by a change to USAF pilot anthropometric entrance requirements. Affected individuals include the following groups: ROTC Cadets, USAFA Cadets, Air Force officers and enlisted members applying for rated positions, civilian adults under 30 who want to pursue a career as a USAF pilot through Officer Training School (OTS), and high school students interested in joining the USAF.

The percentage of USAF officers represented from different commissioning sources is 42.3 percent ROTC, 22.7 percent USAFA, 17.9 percent OTS, 17 percent other sources (Air Force Personnel Center, 2016). ROTC cadets were selected as the sample population based on their broad representation in the research population and on their unique position to choose to pursue a career in the USAF, even while enrolled in the program. As ROTC cadets make their career choices, many of them are experiencing the decision-making process framed by EToM. EToM explains relevant influences on individuals and how that may drive their choices of which achievement activities to pursue (Bembenutty, 2012). The influences affecting ROTC cadet motivation were captured in the 11 EToM first order constructs accounted for in the AFPMQ. These factors affecting ROTC cadet motivation to pursue careers as pilots offer valuable insight for potential USAF policy changes. Utilizing ROTC cadets as the sample population provides good external validity for this research.

An a priori power analysis was used to determine the appropriate sample size. Based on a well-utilized calculation in Equation 1 (Sullivan, n.d.), a sample size of at least 357 cadets is required to attain adequate power at the 95 percent confidence level assuming an estimated standard deviation of 0.635. The standard deviation is calculated based on the average standard deviation reported by Unrau and Schlackman (2006) in their study utilizing the MRQ.

$$N = \frac{(z{-}score)^2\,(std\ dev)(1-std\ dev)}{(margin\ of\ error)^2} \tag{1}$$

Equation 1: Where *N* is the required sample size

Questionnaire participation was solicited from a randomized sample of ROTC detachments. One detachment in every state was contacted, including Puerto Rico and The District of Columbia. Detachments do not exist in Idaho, Maine, and Rhode Island.

Operations Flight Commanders from participating detachments distributed the questionnaire link to cadets via email. It was distributed to 30 ROTC Detachment Operations Flight Commanders and was open for 27 days. To improve response rate, a participation reminder email was sent to Operations Flight Commanders after the questionnaire had been open for 17 days. 398 ROTC cadet subjects completed the questionnaire (80.4 percent completion rate). All participation was done so on a voluntary basis. Operations Flight Commanders were not informed who had filled out the questionnaire, nor were they given access to the raw data questionnaire responses.

Summary

A questionnaire was conducted to answer the research question: How do the current Flying Class I height requirements affect motivation of USAF cadets to pursue careers as USAF pilots? 398 ROTC cadets completed the questionnaire, and their answers were analyzed using Statistical Package for the Social Sciences (SPSS) analysis software. The next chapter of this paper will discuss the results and analysis of the AFPMQ.

IV. Analysis and Results

Chapter Overview

This chapter presents the results of the AFPMQ associated with answering the research question and investigative questions. Linear regression analysis is utilized to explore the correlations and predictive capabilities of the variables of gender and height as related to motivation. This chapter provides evidence of reliable and valid data supporting the findings. The next chapter of this paper will discuss the importance of these findings and make recommendations for increasing cadet motivation to pursue careers as pilots.

Data Overview and Bias

The total number of respondents who entered the questionnaire was 495. To ensure reliable data analysis, responses were screened for full completion. Ninety-seven responses were eliminated from final data analysis based on participants who left 20 or more unanswered questions. Resulting in a final sample size of 398 participants (completion rate of 80.4 percent and response rate of 19.9 percent), which was enough to contribute to a statistically significant sample size based on the a priori power analysis conducted.

A missing values analysis was conducted in SPSS to account for any missing items in the remaining 398 responses. Little's missing completely at random (MCAR) test resulted in a p-value greater than 0.1, hence, no significant pattern was found. Based on this conclusion, a list wise deletion of observations was implemented (Garson, 2015).

To reduce non-response bias, the questionnaire design process described in Section III encompassed a variety of considerations. The questionnaire link was distributed to the cadets via their Operations Flight Commander. Operations Flight Commanders are someone with whom cadets are familiar and cadets might be more inclined to open the link. Questionnaire design accounted for a 15 minute completion time. The short expected duration was relayed to potential participants upfront to help positively influence participation. The questionnaire link was distributed after cadets had returned from winter break to decrease the likelihood that they would be busy with finals or home on vacation. Finally, questionnaire pilot testing was completed to ensure all questionnaire adaptions accurately measured EToM constructs, question wording was clear and concise, and the online format displayed correctly utilizing different web servers and devices.

To examine the degree to which non-response bias is manifest in the data, a test for non-response was conducted. A separate questionnaire consisting of demographic questions was distributed to 25 ROTC Detachment Operations Flight Commanders on 18 April, 2017. The non-response questionnaire took approximately 2 minutes to complete and consisted of the same 15 demographic items from the AFMPQ. The non-response questionnaire targeted cadets who did not participate in the AFPMQ. 154 participants responded to the questionnaire. Statistical t-tests were conducted to determine any significant differences in the AFPMQ respondents versus the non-response questionnaire respondents (Weisberg, Krosnick, & Bowen, 1996). The results show that, on average, the AFPMQ non-respondents were not as interested in becoming pilots. The non-respondents demonstrated slightly lower interest in pilot and other rated career fields, lower flying hours experience, and lower motivation to stay in the USAF for more than 20 years. The AFPMQ respondents were not statistically different than the non-respondents in any other category. The nature of this response bias should not have any effect on the research results because, other than the slightly reduced propensity to want to be a pilot (indicating that they were less invested in the topic of study), the non-respondents were demographically the same as the respondents.

Harman's single factor test was employed to account for common method bias (Teo, 2011). The unrotated principal component factor solution revealed the presence of seven distinct factors with an eigenvalue greater than 1.0: (factor 1: 40.41, factor 2: 5.54, factor 3: 3.26, factor 4: 4.00, factor 5: 3.94, factor 6: 3.81, factor 7: 3.01). These seven factors explain 65.98 percent of the total variance and the largest factor did not account for more than 50 percent of the variance.

The median time to complete the questionnaire was 9 minutes and 15 seconds. Participants had the ability to open the questionnaire and come back to it at a later time, leading to a large variance in completion times. Thus, the completion time data was positively skewed and mean completion time data will not be reported due to inaccuracies.

Demographics

The questionnaire included a demographic section to capture key characteristics of the sample population. The demographic data helps assess who participated in the questionnaire and several demographic categories were used as independent variables during analysis. Table 1 reports the compiled AFPMQ demographic data. Of note, categories do not account for 100 percent of participants based on blank answers.

Table 1 AFPMQ Demographic Data

	Number	Percent			Number	Percent
Gender				Year		
Males	307	77.10%		Freshman	126	31.70%
Females	86	21.60%		Sophomore	99	24.90%
Height				Junior	90	22.60%
Less than 64 inches	47	11.80%		Senior	76	19.10%
Preferred Job in AF				Age		
Pilot	230	57.80%		18	69	17.30%
Other Rated	22	5.50%		19	97	23.40%
Support Officers	56	14.10%		20	90	22.60%
Special Ops/CRO/STO/ALO	17	4.30%		21	73	18.30%
Medical Career Field	16	4.00%		22	32	8.00%
Engineer/Scientist	18	4.50%		greater than 22	31	7.80%
Space Operations	5	1.30%		Flying Experience		
Undecided	10	2.50%		0 hours	195	49%
School Location				1-25 hours	22	5.50%
West Coast	97	24.40%		26-50 hours	29	7.30%
Midwest	121	30.40%		More than 50 hours	29	7.30%
Northeast	49	12.30%		GPA		
Southeast	77	19.00%		2.5 or less	9	2.30%
Other	44	11.10%		2.51-3.0	78	19.60%
				3.01-3.5	156	39.20%
				3.56-4.0	130	32.70%

Reliability and Validity

Internal consistency reliability of each construct was assessed through Cronbach's Alpha. Table 2 shows nine of the eleven constructs had alphas that were 0.70 or greater, demonstrating these constructs have an acceptable level of internal consistency (Chin &

Newsted, 1999). The constructs of “challenges to becoming a pilot” and “work avoidance” had item loading between 0.70 and 0.60, an acceptable range for exploratory constructs (Chin & Newsted, 1999). These two scores are understandable due to the military specific adaptations made from the original validated MRQ constructs. In addition, as shown in Table 2, the average variance extracted (AVE) for each exceeded the suggested .50 threshold of Fornell and Larcker (1981).

All path coefficients were statistically significant and as shown in Table 2, standardized loadings for each construct exceed .50, which provides evidence to suggest adequate convergent validity (Gefen & Straub, 2005; Hazen, Overstreet, & Boone, 2015). Discriminant validity was assessed in two ways. The square root of the AVE for each construct was compared to the correlation between each pair of constructs. To begin, each correlation estimate is smaller than the square root of the AVE for each construct (Fornell & Larcker, 1981). Second, all items had higher loading on their assigned construct than they did on any other construct. Combined, these results provide evidence of discriminant validity (Hazen, Overstreet, & Boone, 2015).

Table 2 Measurement Validation

Construct/item	Mean (SD)	Standardized Loadings	Average Variance Extracted	Cronbach's Alpha	Mean shared variance
Efficacy Expectation			0.59	0.858	0.31
I would be a good pilot.	3.41 (0.87)	0.70			
If I attend pilot training, I will be more successful than most of my peers who attend pilot training.	3.02 (0.93)	0.77			
I would perform better at pilot training than any other Air Force job training	2.76 (1.1)	0.82			
Challenges to becoming a pilot			0.62	0.688	0.27
I think I could realistically be selected for pilot training.	3.23 (1.00)	0.76			
I like challenging tasks.	3.63 (0.62)	0.67			
If I am determined, I can succeed in pilot training, despite the difficulties.	3.65 (0.78)	0.61			
I do not think it will require more work for me to get a pilot slot when compared to other cadets at my school.	2.22 (0.96)	0.70			
If I am interested in something, I do not care how challenging the task may be to complete.	3.62 (0.68)	0.82			
Intrinsic Value			0.72	0.878	0.40
If I hear something about being a pilot that I find interesting, I will take the initiative to follow up and learn more about it on my own.	3.25 (0.97)	0.89			
I sometimes lose track of time if I am doing something related to flying planes (watching a movie, flying a remote control plane, playing a video game, etc.).	2.45 (1.10)	0.84			
Flying a plane is something that interests me.	3.57 (0.88)	0.68			
In my free time, I have hobbies related to flying (movies, video games, remote control planes, etc.)	2.90 (1.06)	0.82			
I like to learn about new things related to flying	3.36 (0.96)	0.79			
I would be interested in learning about differences in other United States military pilot training pipelines (e.g. United States Navy and/or United States Army).	3.09 (0.99)	0.80			
Attainment/Importance			0.65	0.916	0.34
It is important for me to be successful during pilot training.	3.41 (1.01)	0.90			
When compared to other activities I do, it is very important for me to become a good pilot.	3.08 (1.11)	0.82			
It is important for me to be accepted into the pilot training program.	2.99 (1.18)	0.75			
Compliance			0.59	0.742	0.29
I have voluntarily participated in additional opportunities (e.g., flight programs, extra classes, etc.) to improve my chances of getting a pilot slot.	2.67 (1.21)	0.74			
I always complete tasks exactly how my instructors want.	3.19 (0.72)	0.62			
Enrolling in classes or programs that will help me get a pilot slot is important to me.	2.93 (1.11)	0.69			
Getting a pilot slot motivates me to finish my assignments on time.	3.03 (1.17)	0.78			
Extrinsic Recognition			0.62	0.897	0.42
I would like for people to think of me as a good pilot.	3.39 (1.03)	0.83			
People sometimes tell me that I would be or that am a good pilot.	2.93 (1.06)	0.68			
I like to get compliments about my pilot abilities or my abilities to earn a pilot slot.	2.82 (1.10)	0.88			
I am happy when someone recognizes my potential to become a pilot from my commissioning source.	3.22 (1.03)	0.87			
Air Force value of pilots			0.59	0.713	0.22
I think I will be more likely to be promoted if I become an Air Force pilot.	2.60 (1.02)	0.81			
I look forward to the respect I will get from my peers if I become an Air Force pilot.	2.99 (1.09)	0.77			
I want to be a pilot to improve the likelihood that I will reach a high rank in the Air Force.	1.95 (0.96)	0.79			
My family members ask me about what life would be like as an Air Force pilot.	2.77 (1.08)	0.72			

Construct/item	Mean (SD)	Standardized Loadings	Average Variance Extracted	Cronbach's Alpha	Mean shared variance
Social reasons for becoming a pilot			0.70	0.869	0.38
Many of my friends are planning to be pilots.	2.65 (0.99)	0.88			
My peers and I give each other advice on pilot career paths.	2.70 (1.09)	0.85			
I sometimes discuss flying programs or the pilot career path with my leadership.	2.87 (1.09)	0.87			
I talk to my friends about flying programs or a career as a pilot.	3.02 (1.12)	0.82			
I like to help my friends with understanding flying programs.	2.75 (1.05)	0.82			
I like to tell my family about my flying experiences or my possibilities of a future career as a pilot.	2.87 (1.13)	0.78			
Extrinsic Competitive Value			0.71	0.888	0.39
I try to get higher scores on tests than my peers.	3.59 (0.68)	0.88			
I would like to be the best pilot in the Air Force.	3.25 (1.07)	0.89			
I would like to finish pilot training before any of my classmates.	2.60 (1.06)	0.88			
I would like to be one of the few people selected for pilot training.	3.36 (1.08)	0.85			
It is important for me to see my name on the list of pilot training selectees.	3.04 (1.17)	0.78			
I am willing to work hard to be a better pilot than my peers.	3.33 (1.01)	0.82			
Work Avoidance			0.57	0.605	0.25
I would not enjoy solving complex problems in the plane.	1.74 (0.96)	0.77			
I do not like the process for me to get a pilot slot because it is difficult.	1.67 (0.80)	0.69			
The complexity of becoming a pilot deters me from wanting to pursue a pilot slot.	1.47 (0.80)	0.78			
Cost			0.60	0.725	0.28
It will be overly stressful for me to go through the process of becoming a pilot	1.78 (0.87)	0.80			
It is not worth the effort for me to become a pilot	1.39 (0.77)	0.83			
The 10-year Air Force commitment following pilot training deters me from wanting to pursue a pilot slot.	1.74 (1.00)	0.78			
Becoming a pilot would cause me to give up other things I want to accomplish in life.	2.03 (1.07)	0.77			
There are things about being a pilot that I would not like	2.17 (1.01)	0.79			

Linear Regression Model

Initial data distribution analysis and residual plots in SPSS demonstrated approximately normally distributed data with a linear relationship between variables. No issues with homoscedasticity were found and it was concluded that there were no problems with the statistical assumptions to support linear regression model for analysis (Aldrich & Cunningham, 2016).

The first order constructs depicted in Figure 8 represent the observable variables individuals reported that provide indicators to the second order constructs of expectations of success and value of becoming a pilot (Ping, 2002). As framed by EToM, the first and second order constructs are all categorized under the third order construct of motivation, which was utilized as the dependent variable during analysis.

Investigative Questions Answered

Investigative Question 1: Does gender affect cadet motivation to pursue careers as USAF pilots?

Addressing the relationship between gender and motivation (using gender as the IV in a regression equation), results indicated the R square and adjusted R square for this regression was .150 and .148 respectively and the $F(1,391) = 68.835$, $p = .000$. The t value had a $p = .000$ (Table 3), leading to the conclusion that gender is a significant predictor of motivation to pursue a career as a USAF pilot. Females demonstrate lower motivation to become pilots.

Table 3 Motivation vs. Gender

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	3.243	.033		99.312	.000
	Q52_num	-.579	.070	-.387	-8.297	.000

a. Dependent Variable: Motivation

To further examine this question, two scatter plots demonstrating the linear trend between motivation and gender were produced using excel (Figure 9 and Figure 10). Figure 9 represents male motivation (via final AFPMQ). The y-intercept or average motivation score for the male participants is 3.21. Figure 10 represents female motivation (via final AFPMQ). The y-intercept or average motivation score for female participants is 2.69. These scatterplots provide visual evidence to further demonstrate females' lower motivation to become pilots.

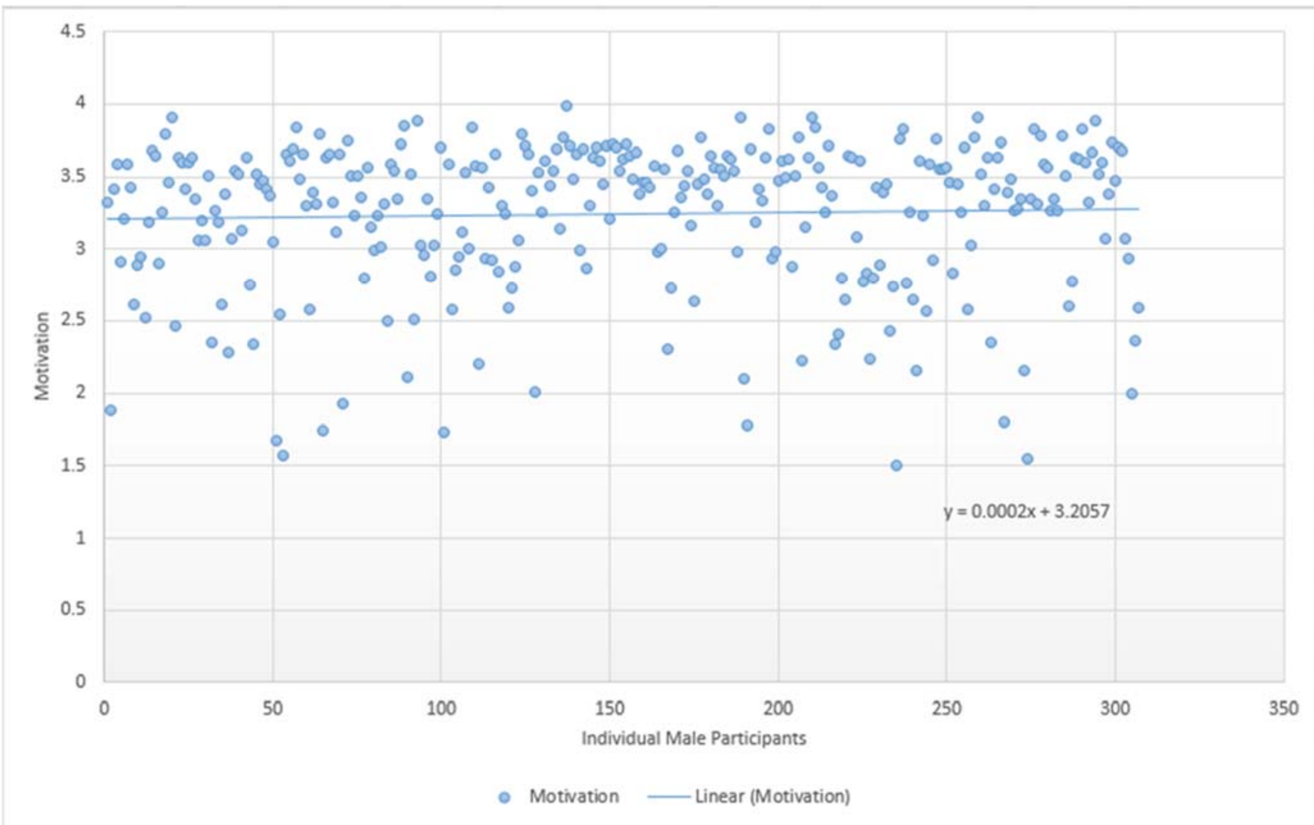


Figure 9 Motivation vs. Male Participants

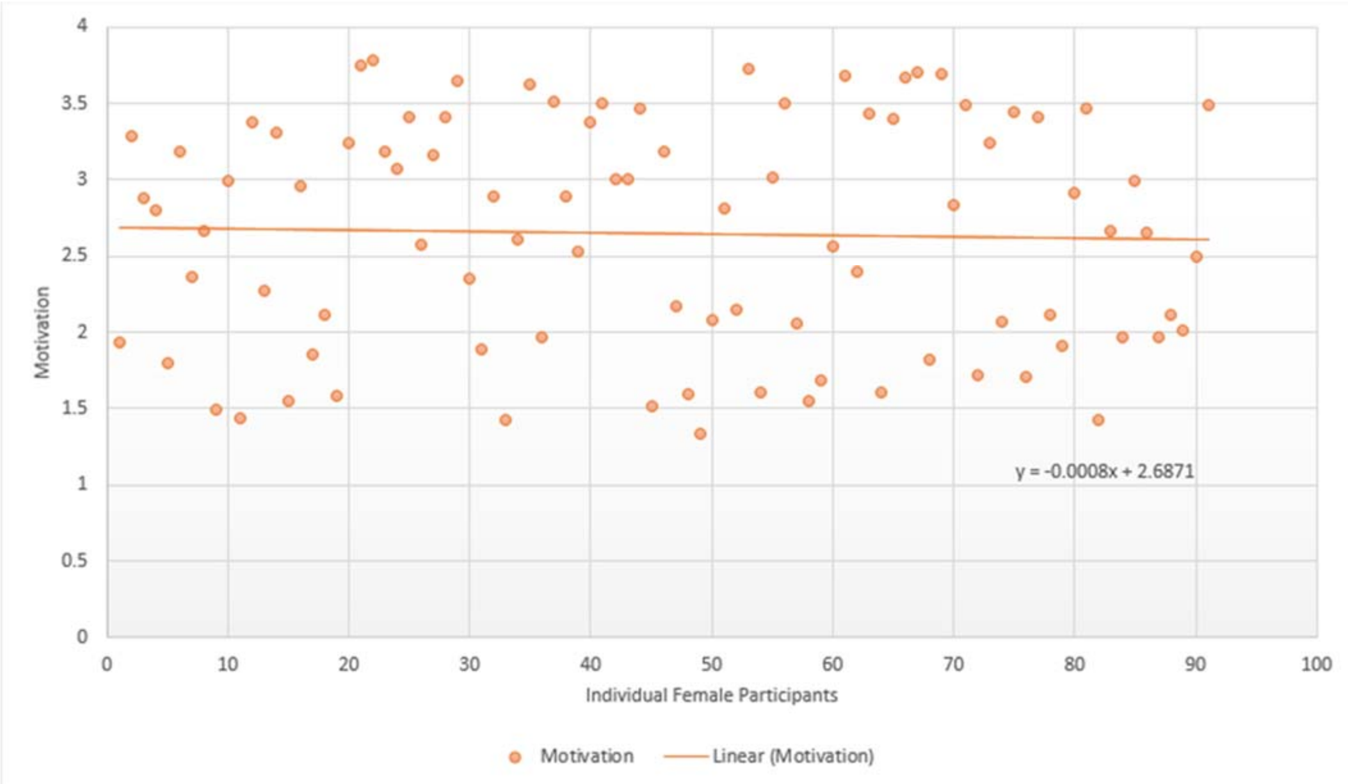


Figure 10 Motivation vs. Female Participants

Investigative Question 2: Does standing height affect cadet motivation to pursue careers as USAF pilots?

Addressing the relationship between standing height and motivation (using standing height as the IV in a regression equation), results indicated the R square and adjusted R square for this regression was .068 and .066 respectively and the F(1,385) = 28.179, p = .000. The t value had a p = .000 (Table 4), leading to the conclusion that height significantly helps predict motivation to pursue a career as a USAF pilot. The data supports the conclusion that shorter people demonstrate lower motivation to become pilots. However, the amount of variance (R square values) in motivation as predicted by height is only half of that predicted by gender.

Table 4 Motivation vs. Height

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.391	.513		.761	.447
	Q62	.039	.007	.261	5.308	.000

a. Dependent Variable: Motivation

A scatter plot (Figure 11) further demonstrates these results to show the linear trend between motivation and height. The red line depicts the Air Force Instruction 48-123 (2011) minimum standing height requirement of 64 inches. Individuals to the left of this line are not pilot qualified based not meeting the minimum standing height. Of note, there were seven respondents who reported heights that were outside the upper limit of the Air Force Instruction 48-123 (2011) standing height requirements. These respondents account for the data points at the far right. Highly motivated individuals are those with scores of 3 and 4 (above the blue line), and lower motivated individuals are those with scores of 1 and 2 (below the blue line). The ratio of highly motivated individuals and lower motivated individuals to the left of the red line compared to the ratio of highly motivated individuals and lower motived individuals to the right of the line, demonstrates that there is a larger ratio of motivated individuals in the group that is pilot qualified based on standing height. This graphical depiction further supports that shorter people demonstrate lower motivation to pursue careers as USAF pilots.

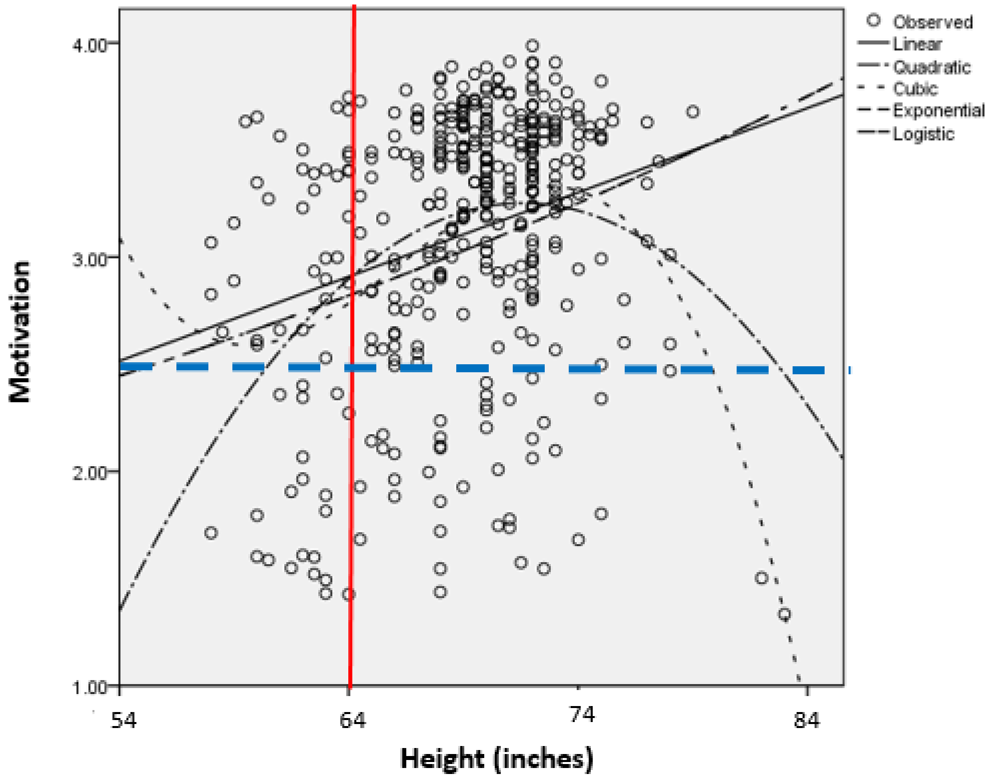


Figure 11 Motivation vs. Height

Addressing the relationship between gender and standing height, and motivation (using standing height and gender as the IVs in a regression equation), results indicated the R square and adjusted R square for this regression was .160 and .155 respectively and the F(2,383) = 36.383, p = .000. The t values had p = .000 and p = .599 for gender and height respectively (Table 5), leading to the conclusion that in this model height is no longer a significant predictor of motivation to pursue a career as a USAF pilot. In a model containing both gender and height, the independent variable of gender overshadows the effect of the independent variable of height due to their covariance.

Table 5 Motivation vs. Gender & Height

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	2.914	.623		4.679	.000
	Q52_num	-.572	.088	-.380	-6.482	.000
	Q62	.005	.009	.031	.526	.599

a. Dependent Variable: Motivation

A Pearson's correlation coefficient was computed to assess the relationship between gender and height. Pearson's correlation provides evidence to support the lack of height's predictive capability when motivation is regressed on gender and height. Table 6 shows that gender and height are significantly correlated (r = -.602, n = 386, p = 0.000).

Table 6 Pearson Correlation Gender & Height

Correlations

		Q52_num	Q62
Q52_num	Pearson Correlation	1	-.602**
	Sig. (2-tailed)		.000
	N	393	386
Q62	Pearson Correlation	-.602**	1
	Sig. (2-tailed)	.000	
	N	386	387

**. Correlation is significant at the 0.01 level (2-tailed).

Research Question Analysis

This research focuses on cadet motivation to pursue careers as USAF pilots. The purpose of this research is to determine how gender and height affect motivation to pursue a pilot career. Each of the individual 11 first order constructs was regressed on gender to help answer the research question: How do the current Flying Class I height requirements affect motivation of USAF cadets to pursue careers as USAF pilots? Post hoc regression shows gender as significantly related to all 11 first order constructs of motivation and total expectancy-value motivation.

Summary

This chapter presented a series of regression models to demonstrate the predictive capability of gender and height on motivation. These results supported the conclusion that both females (gender) and shorter individuals (standing height) have a significantly lower motivation to pursue careers as USAF pilots. Overall gender was the strongest predictor in determining motivation to become a pilot.

Regression analytics also demonstrated that gender is significantly correlated to each of the 11 first-order constructs of motivation measured in the AFMPQ, and the total motivation score as a whole. The potential for the USAF to influence these first order constructs as framed by EToM will be discussed in the next chapter.

V. Conclusions and Recommendations

Chapter Overview

Females are underrepresented in the USAF pilot career field (Cleaves, 2016). This research on the motivations of ROTC cadets demonstrates that current trend could remain true for the foreseeable future without adaptions to USAF policy. The next section will discuss the significance of these research findings and how the USAF can leverage this research to motivate more women to become pilots.

Conclusions of Research

The current USAF pilot qualification policy eliminates approximately 55 percent of the female population and approximately 6 percent of the male population from initial pilot qualification based on height restrictions (Hudson, Zehner, & Roinette, 2003). Additionally, there is a disproportionate lack of female representation in the USAF pilot career field when compared to the national population (Losey, 2015; Cleaves, 2016).

This research focuses on cadet motivation to pursue careers as USAF pilots. The purpose of this research is to determine how gender and height affect motivation to pursue a pilot career. The results of the AFPMQ, completed by 398 ROTC cadets, indicate that gender and height both independently help predict cadet motivation to pursue careers as USAF pilots. Females and cadets of shorter stature reported the lowest levels of motivation to pursue careers as USAF pilots. Gender had the strongest predictive capability: females exhibited a significantly lower motivation to be pilots in all 11 first order constructs identified by the EToM measurement tool.

Based on the AFPMQ results, it can be concluded that the current USAF status quo is not adequate to motivate women to pursue careers as pilots. Successfully solving the question of how do the current Flying Class I height requirements affect motivation of USAF cadets to pursue careers as USAF pilots, is complex as it involves human behavioral patterns (e.g., motivation) and resource management (e.g., process ownership, software updates). This research shows that motivational levels, related to EToM are significantly correlated to gender; thus, providing the point of reference for future research to address female motivation as related to becoming a pilot in the USAF. Utilizing the EToM structure, making changes to increase female motivation in any one construct, should have a positive effect on the overall motivation for females to become pilots. Recommendations for this paper will focus on affecting the constructs of challenges to becoming a pilot, work avoidance, and cost.

Implementing a pilot height qualification policy based on tailored anthropometric accommodations could potentially impact the three constructs of challenges to becoming a pilot, work avoidance, and cost. Challenges to becoming a pilot relates to efficacy expectation and the satisfaction of mastering challenging tasks (Wigfield, Guthrie, & McGough, 1996). Implementing a tailored height requirement policy could influence efficacy expectation challenges associated with this construct. An anthropometrically tailored approach would lower the minimum height for pilot qualification, thus possibly increasing females' expectation that they could realistically be assigned a pilot slot. A tailored approach would not only produce a more inclusive pool of candidates, but eliminate the need for anthropometric waivers, thus eliminating a barrier to the pilot career field.

Current Air Force Instruction 48-123 (2011) height standards put approximately 55 percent of females in a scenario where they require an anthropometric waiver to become a USAF pilot (Hudson, Zehner, & Roinette, 2003). When considering the waiver requirement in the context of the work avoidance construct and the cost construct, a larger number of women have to exert more energy to get a pilot slot than their male counterparts. Both work avoidance and cost involve the amount of energy it will take to accomplish a task (Wigfield, Guthrie, & McGough, 1996, Wigfield & Eccles, 2000). Eccles (1983) states that in accordance with EToM, as these two constructs decrease, it is likely there will be an associated increase in overall motivation. Eliminating the need for a waiver might increase the motivation of those females who perceive the waiver process as a significant burden. A policy change to a tailored anthropometric height requirement would eliminate the need for a waiver, and thus and barrier to entry.

Low female motivation futher suggests an updated investigation (and endorsements) into anthropometric requirements for pilots. The current waiver process strenthens the unarguably arbritatry status quo requirements and deflates the USAF goal to increase female officer numbers. More research is needed to tease out additional perceived challenges faced by females interested in entering the USAF pilot training pipeline. However, the presented results of this research provide a valid starting point for shifting the current status quo.

Significance of Research

The USAF is experiencing a pilot shortage that is projected to increase over the next decade (Cooper, 2016). Additionally, in 2015, the USAF set a goal to increase the

USAF female officer applicant pool to 30 percent based on the disproportionate representation of USAF females compared to the national population (Losey, 2015; Cleaves, 2016). In the Department of Defense's fiscally constrained environment of today, the solutions to any USAF challenges require minimal resources. Implementing a tailored pipeline protocol for pilot qualification based on anthropometric compatibility would help increase the pool of qualified pilot candidates and potentially increase the female officer applicant pool, all while utilizing existing USAF resources.

The significance of this research it not just related to an increase pilot applicant pool and cost savings. Changing the legacy pilot height requirements would mean changing a policy that perpetuates unintended discrimination.

Recommendations for Action

The USAF should change the pilot height requirements in Air Force Instruction 48-123 (2011). The new requirements should be based on the anthropometric accommodation envelopes established by AFRL (Zehner & Hudson, 2002). The following recommendations outline the requirements for change.

Similar to the USN, the USAF should establish an initial screening height for qualification. The AFRL can utilize webPASS along with data from past studies to determine the new minimum and maximum height requirements. Anyone outside of the initial screening height will be unable to medically qualify as a USAF pilot, and anthropometric waivers will not be accepted. Once an initial screening height is established, the new process can be implemented in a similar manner as the USN's flight screening process.

All applicants who pass the initial height screening will be required to give the same eight cardinal measurements currently required for waiver applicants: standing height, sitting height, buttock-knee-length, sitting knee height, arm span, sitting eye height, acromial height, and functional reach (USAF AWG, 2014). The Medical Flight Screening (MFS) clinic personnel will be responsible for entering these measurements into webPASS. Currently, MFS personnel enter these measurements into Aeromedical Information Management Waiver Tracking System (AIMWTS) to be sent to AETC/SGPA (SSgt Nicole Girimonte, personal communication, October 19, 2016). The new process would eliminate the need for AIMWTS to be used at all for anthropometric requirements. Removing the waiver requirement and moving the webPASS entry from the AETC/SGPA to the MFS clinics would marginally increase the workload for the clinics, but reduce the waiver workload on AETC staff. This new process would cost MFS personnel approximately five additional minutes per pilot candidate, while freeing time for AETC staff to address other medical waivers.

Similar to the USN, the USAF should establish the minimum number of aircraft in which candidates must qualify to be considered for acceptance. By codifying this requirement, MFS clinic personnel will be able to notify cadets instantaneously of their anthropometric qualification status. This part of the process will help increase candidates' expectancy for success because they will have immediate and accurate feedback.

This recommended process has potential to increase the number of qualified pilot candidates, specifically female candidates, and tangentially eliminate a policy that perpetuates unintended discrimination. However, there are second and third order consequences of this recommended policy that deserve consideration.

Recommendations for Future Research

This research targeted policy changes that could influence expectancy-value based motivation, specifically, women pursuing careers as USAF pilots. The scope of this research was designed to analyze motivation as related to the targeted area of FCI anthropometric requirements. Second and third order consequences of the FCI anthropometric policy change recommendation could not be adequately explored within the purview of this research, leaving several areas of future research open for study.

As previously mentioned, in today's fiscally constrained environment, required cost and resources associated with implementing a new policy must be understood. Future research could focus on the potential monetary and resource related savings and costs affected by an anthropometric requirements change. There is potential for time-saving on AETC staff and potential for increased workload in MFS clinics. The actual analysis in these areas needs to be examined. Establishing a new screening height requirement and a minimum aircraft qualification requirement would also place an additional temporary burden on AFRL staff and AETC staff respectively. Use of these resources requires consideration. Another resource that requires consideration is webPASS. Implementing the recommended policy would increase the use of webPASS. It is important to review the software and ensure it can handle the expanded use. The actual cost and savings analysis in these areas needs to be examined.

An additional direction for future research is the ability to track tailored anthropometric qualifications throughout an officer's career. Any individual anthropometric limitations should be considered for aircraft changes or Permanent Change of Station. Currently, anthropometric specific qualifications are processed as waivers and are tracked using AIMWTS. The recommended policy eliminates the need for anthropometric waivers in AIMWTS, thus requiring a new tracking system. The USN utilizes officers' Aviation Training Jacket and Naval Air Training and Operating Procedures Standardization jacket to track individual anthropometric coding requirements (USN OPNAVINST 3710.37A, 2006). The USAF equivalent might be utilizing the Aircrew Resource Management System database or Flight Evaluation Folders to track individual requirements. However, a thorough review of how to best implement a tracking system is required.

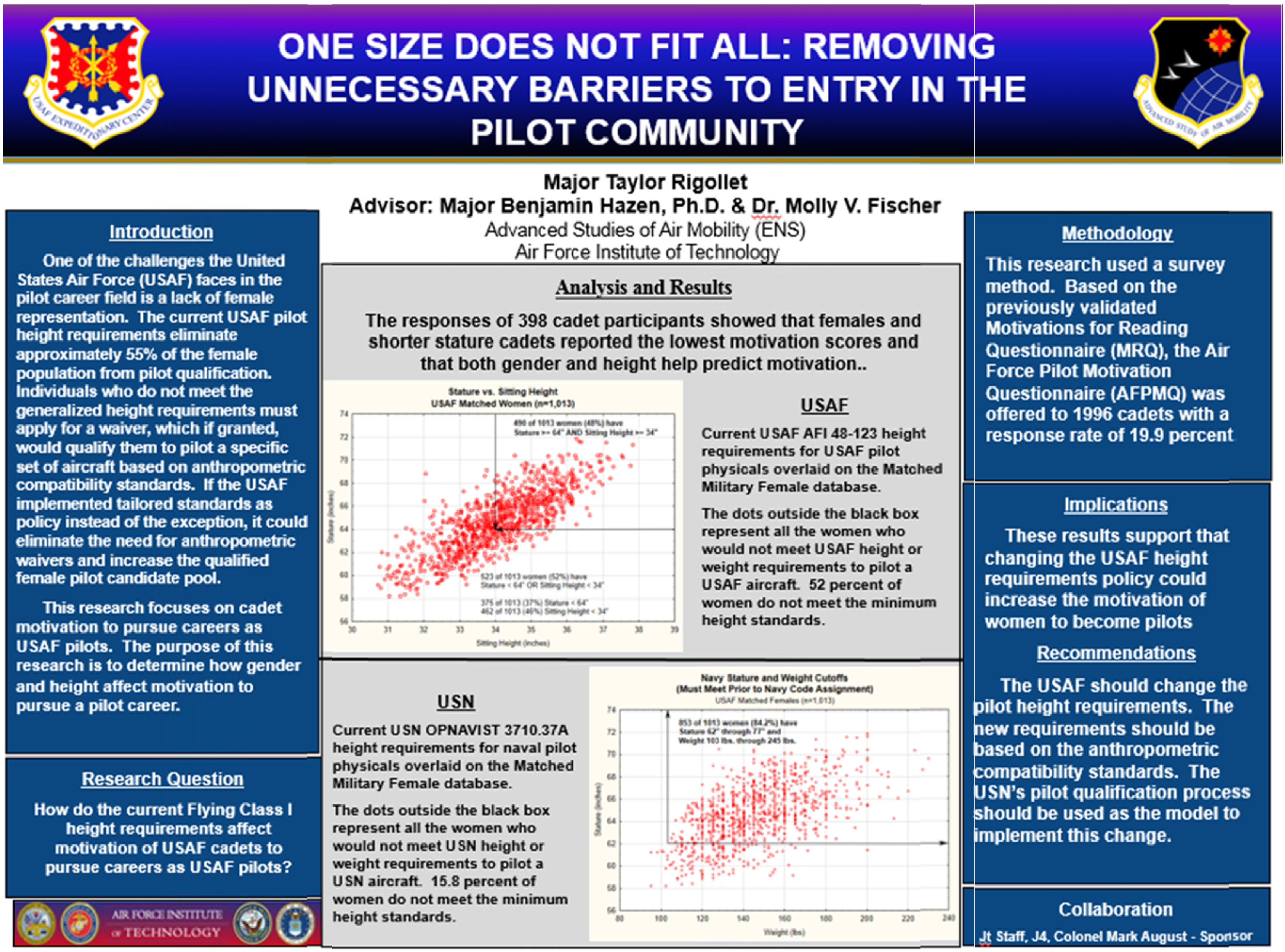
Finally, via the AFPMQ, this research tangentially utilized 11 constructs of motivation all reporting scores lower in females than their male counterparts. Future research should look at these constructs individually as primary demotivating factors in potential female pilot applicants. The results of such investigation could later influence current indirectly discriminatory USAF policy. The current USAF status quo has proven to be inadequate for motivating women to pursue careers as pilots. Developing policy changes to enhance motivational advancement for would-be female pilots could positively impact the USAF status quo for female pilot recruitment, qualification, and retention.

Summary

Today's USAF is focused on approaching problems using critical thinking and implementing agile and adaptive solutions. Instilling this organizational culture in force as large as the USAF is a challenge. However, organizations that truly represent an innovative culture are organizations that outlast all others. Part of inspiring this type of culture is recognizing weaknesses within the organization and being willing to make bold changes to eliminate these weaknesses. The USAF has recognized their pilot shortage problem and their underrepresentation of female pilots (Cooper, 2016; Cleaves, 2016). Now, it is time for the USAF to be bold, and make changes that will strengthen these weaknesses.

Making bold decisions does not mean making decisions without thought and consideration of the consequences. On the contrary, bold decisions must be well thought-out and based on critical thinking. This research paper provides data framed by EToM to support the consideration of a change to the USAF pilot anthropometric requirements. EToM has been identifed by researchers as one of the most promising approaches to individual motivation and has ofered some key insights to cadet motivation to support the proposed policy change (Ferris, 1977). Areas of future research should be reviewed prior to policy implementation. However, the data in this research shows that it would be beneficial for the USAF to move forward with the recommended anthropometric policy change. The recommended policy could change the USAF status quo for a broader range of pilots, making the force better able to meet future challenges.

Appendix A Quad Chart



Appendix B AFPMQ

Air Force Pilot Motivation Questionnaire

Purpose/Introduction

Thank you for taking the time to participate in this questionnaire. You were specifically selected as a possible participant in this study because of your unique position as a cadet who is about to begin a career in the Air Force. The main purpose of this study is to gain a better understanding of your motivation to pursue a career as an Air Force pilot. Your inputs will help shape Air Force policy. The questionnaire takes about 15 minutes to complete. If you have any questions about the survey, please feel free to email: taylor.rigollet@us.af.mil

You should read the information below.

- This questionnaire is voluntary. You have the right to not respond to any question. You may also end participation at any time without penalty.

- There is no compensation for this questionnaire.

- All information provided will remain confidential.

- Data collection for this project will be completed by April 2017. All questionnaire documents will be stored in a secure work space until 1 year after that date. The documents will then be destroyed.

- The data you provide will be compiled with an accompanying analysis by the summer. If you would like a copy of this report, please email taylor.rigollet@us.af.mil with your request.

Click “Next” if you understand the procedures described above and agree to participate in this study.

Expectancy Theory of Motivation Questionnaire

We are interested in determining what factors may influence your motivation to pursue a career as an Air Force pilot. Note: Any reference to “pilot” in the survey is referring to flying a traditional manned aircraft (not a Remotely Piloted Aircraft - RPA).

Read each sentence and decide whether it talks about a person who is like you or different from you utilizing the following scale:

Very Different From Me	A Little Different From Me	A Little Like Me	A Lot Like Me
1	2	3	4

Efficacy Expectations: *The belief that one can be successful getting a pilot slot.*

1. I would be a good pilot.
2. If I attend pilot training, I will be more successful than most of my peers who attend pilot training.
3. I would perform better at pilot training than any other Air Force job training

Challenges to becoming a pilot: *Satisfaction of mastering challenging tasks. Challenge as related to efficacy expectation. Efficacy expectation is high for a cadet who likes challenging tasks and thinks they could complete pilot training.*

4. I think I could realistically be selected for pilot training.
5. I like challenging tasks.
6. If I am determined, I can succeed in pilot training, despite the difficulties.
7. I do not think it will require more work for me to get a pilot slot when compared to other cadets at my school.
8. If I am interested in something, I do not care how challenging the task may be to complete.

Intrinsic Value: *The interest and enjoyment one gets from an activity.*

9. If I hear something about being a pilot that I find interesting, I will take the initiative to follow up and learn more about it on my own.
10. I sometimes lose track of time if I am doing something related to flying planes (watching a movie, flying a remote control plane, playing a video game, etc.).
11. Flying a plane is something that interests me.
12. In my free time, I have hobbies related to flying (movies, video games, remote control planes, etc.)
13. I like to learn about new things related to flying.
14. I would be interested in learning about differences in other United States military pilot training pipelines (e.g. United States Navy and/or United States Army).

Attainment/Importance: *Nature of individual's value for a given task. How the outcome of that task fundamentally aligns with how they see themselves.*

15. It is important for me to be successful during pilot training.
16. When compared to other activities I do, it is very important for me to become a good pilot.
17. It is important for me to be accepted into the pilot training program.

Compliance: *Accomplishing a task based on an external goal. Utility: How a task fits into an individual's future plans.*

18. I have voluntarily participated in additional opportunities (e.g., flight programs, extra classes, etc.) to improve my chances of getting a pilot slot.
19. I always complete tasks exactly how my instructors want.
20. Enrolling in classes or programs that will help me get a pilot slot is important to me.
21. Getting a pilot slot motivates me to finish my assignments on time.

Extrinsic Recognition: *Gratification for receiving a tangible form of recognition for accomplishing the task. Utility value as related to extrinsic motivation.*

22. I would like for people to think of me as a good pilot.
23. People sometimes tell me that I would be or that am a good pilot.
24. I like to get compliments about my pilot abilities or my abilities to earn a pilot slot.
25. I am happy when someone recognizes my potential to become a pilot from my commissioning source.

Air Force Value of Pilots: *Desire to be favorably evaluated by the Air Force. Utility value as related to future plans in the Air Force.*

26. I think I will be more likely to be promoted if I become an Air Force pilot.
27. I look forward to the respect I will get from my peers if I become an Air Force pilot.
28. I want to be a pilot to improve the likelihood that I will reach a high rank in the Air Force.
29. My family members ask me about what life would be like as an Air Force pilot.

Social Reasons for becoming a pilot: *Intrinsic gains from being a part of the pilot community in the Air Force. Attainment value as related to how a being a pilot would be fundamentally aligned within a social construct for how cadets see themselves.*

30. Many of my friends are planning to be pilots.
31. My peers and I give each other advice on pilot career paths.
32. I sometimes discuss flying programs or the pilot career path with my leadership.
33. I talk to my friends about flying programs or a career as a pilot.
34. I like to help my friends with understanding flying programs.
35. I like to tell my family about my flying experiences or my possibilities of a future career as a pilot.

Extrinsic Competitive Value: *Desire to outperform others. As related to Importance: important it is for the cadet to do well at the task of pilot training.*

36. I try to get higher scores on tests than my peers.
37. I would like to be the best pilot in the Air Force.
38. I would like to finish pilot training before any of my classmates.
39. I would like to be one of the few people selected for pilot training.
40. It is important for me to see my name on the list of pilot training selectees.
41. I am willing to work hard to be a better pilot than my peers.

Work Avoidance: *What cadets do not like about being a pilot or getting a pilot slot*

42. I would not enjoy solving complex problems in the plane.*
43. I do not like the process for me to get a pilot slot because it is difficult.*
44. The complexity of becoming a pilot deters me from wanting to pursue a pilot slot.*

Cost: *Energy and emotional cost required to accomplish the task (negative consequences for being a pilot)*

45. It will be overly stressful for me to go through the process of becoming a pilot *
46. It is not worth the effort for me to become a pilot *

47. The 10-year Air Force commitment following pilot training deters me from wanting to pursue a pilot slot. *
48. Becoming a pilot would cause me to give up other things I want to accomplish in life.*
49. There are things about being a pilot that I would not like *

* Reverse scoring

Height Discrimination Questions

50/51. Have you ever been precluded from an occupationally relevant task or training due to height? If yes, what was the task?

Demographics Questions

52. What is your gender? Male___ Female_____

53. What is your age? _______ years

54. What year of college are you in?

Freshman_____ Sophomore______ Junior_____ Senior_____

55. Please list your undergraduate college: ____________

56. As a cadet, how likely are you to seek entrance into the pilot training pipeline upon graduation?

Completely Unlikely	Very Unlikely	Unlikely	Somewhat Unlikely	Undecided	Somewhat Likely	Likely	Very Likely	Completely Likely
1	2	3	4	5	6	7	8	9

57. As a cadet, how likely are you to seek entrance into the Remotely Piloted Aircraft (RPA) training pipeline upon graduation?

Completely Unlikely	Very Unlikely	Unlikely	Somewhat Unlikely	Undecided	Somewhat Likely	Likely	Very Likely	Completely Likely
1	2	3	4	5	6	7	8	9

58. As a cadet, how likely are you to seek entrance into the Combat Systems Officer (CSO) or Air Battle Manager (ABM) training pipeline upon graduation?

Completely Unlikely	Very Unlikely	Unlikely	Somewhat Unlikely	Undecided	Somewhat Likely	Likely	Very Likely	Completely Likely
1	2	3	4	5	6	7	8	9

59. What is your preferred occupation post-commission? _________________

60. What is your cumulative GPA: ___________

61. How much flying experience in a pilot or co-pilot role, do you have?
0 hr___ 1-25 hrs____ 26-50 hrs____ more than 50_____

62. How tall are you? (in inches): Drop down with 60 – 84 inches (e.g. 60, 60.5, 61, 61.5)

63/64. Please list your best estimates of the Air Force minimum requirements for the following:
Flying Class 1 (pilot) physical minimum standing height (inches)______
Flying Class 1 (pilot) physical minimum sitting height (inches)______

65. How long do you think you will stay in the Air Force?

My Minimum Commitment	6-8 Years	9-11 Years	12-14 years	15-17 Years	18-20 Years	More Than 20 Years
1	2	3	4	5	6	7

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14. ABSTRACT
One of the challenges the United States Air Force (USAF) faces in the pilot career field is a lack of female representation. The current USAF pilot height requirements eliminate approximately 55% of the female population from pilot qualification. Individuals who do not meet the generalized height requirements must apply for a waiver, which would qualify them to pilot a specific set of aircraft based on anthropometric compatibility standards. If the USAF implemented tailored standards as policy instead of the exception, it could eliminate the need for anthropometric waivers and increase the qualified female pilot candidate pool. This research focuses on cadet motivation to pursue careers as USAF pilots. The purpose of this research is to determine how gender and height affect motivation to pursue a pilot career. A survey methodology was employed to answer the research question: "How do the current Flying Class I height requirements affect motivation of USAF cadets to pursue careers as USAF pilots?" The survey results showed that both gender and height help predict motivation. These results support the claim that changing the USAF height requirements policy could increase the motivation of women to become pilots.

15. SUBJECT TERMS
Expectancy Theory of Motivation, Pilot qualification, Survey, Questionnaire, Anthropometric, Tailored Pipeline, Height Waiver, Female Pilots

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